

## Carbon Monoxide Poisoning - Fact Sheet

### What is Carbon Monoxide?

Carbon monoxide (CO) is a colorless, odorless gas produced through incomplete combustion. CO is a poison that binds with hemoglobin, the oxygen-carrying molecule in human blood. Because CO's affinity to bind with hemoglobin is 250 times greater than oxygen, low airborne concentrations and long exposure times can result in substantial carboxyhemoglobin (COHb) concentrations in the blood. COHb is CO bound to hemoglobin. As COHb levels increase, less hemoglobin is available for the transport of oxygen. This lack of oxygen-carrying capability, which is indicated by the increase in COHb, results in the symptoms we associate with CO poisoning.

### Health Impacts

The acute health effects of CO exposure are well established. Mild exposure symptoms may include headache, dizziness, decreased vigilance, decreased hand-eye coordination, weakness, confusion, disorientation, lethargy, chest pain (in cardiac patients), nausea, and visual disturbances. Greater or prolonged exposure can cause unconsciousness and death. The severity of symptoms depends on the concentration of CO, length of exposure, and degree of physical activity, as well as the state of health of the exposed individuals. People who are exposed to high CO concentrations for long periods of time during strenuous activity will reach the highest COHb levels.

### Sensitive Populations

Age and general health may affect susceptibility to CO. Even low levels of CO can present a health risk to susceptible individuals, such as persons with heart disease, sickle cell disease, and anemia. Also, exposure to low levels of CO may harm the developing fetus.

Angina pectoris is chest pain associated with impaired oxygen flow to the heart and may occur at COHb levels between 2.5 and 4.9 percent in cardiac patients. In healthy individuals decreased vigilance, confusion and disorientation, behavioral, and central nervous system effects occur at COHb levels between 4 and 6 percent. *Remember that as symptoms of CO poisoning increase, you may become confused and less capable of making decisions that could save your life.*

### Sources of Carbon Monoxide

#### Environmental Pollution

The National Ambient (outdoor) Air Quality Standard for CO is nine parts per million (ppm) averaged over an 8-hour period or 35 ppm averaged over one hour. These standards are based on preventing adverse effects in individuals with cardiac

or vascular disease and in exercising humans. Seattle, Spokane, Yakima, and parts of Pierce and Thurston Counties may exceed these values during heavy traffic periods and when inversions occur. Inversions occur when cold stable air layers form above warmer air. This traps pollutants beneath the stable air layer. This can result in significant pollutant level increases, including CO. As outdoor levels increase due to peak traffic times, or because of an inversion, indoor levels will rise proportionately. If indoor sources of CO exist, indoor levels will be higher than those outside. *Avoid strenuous physical activity during peak traffic times, in high volume traffic areas, and during inversions.*

### **Appliances**

Indoor wood stoves, gas ranges, gas hot water heaters, gas and oil heaters, furnaces, and kerosene space heaters can all be sources of CO. Heating season is a time of particular concern with regard to CO exposure. Gas and oil heaters that have not been used during the warm summer months should not be expected to perform efficiently without the benefit of service. It is imperative that furnaces be cleaned and serviced following the manufacturers instructions. Winter is also the time of year when people use space heaters. *It is very important to use the correct grade of kerosene (1-K or manufacturers suggested grade). Use of the incorrect grade of fuel will result in an increased production of CO.*

Flame color is a good way to check the combustion of a fuel-burning appliance. The flame should burn with a bright blue color. A yellow flame signals poor combustion and may indicate a problem with the flue or burner. Ideally, combustion air for fuel burning appliances should not be drawn from inside the home. Some newer furnaces draw air from outside the home and this alleviates the possibility of back drafting. Fuel burning appliances which do not draw combustion air from outside the home are subject to back drafting, which occurs when flue gases, including CO, are drawn back through the flue into the living space in the home. This occurs because of an air pressure drop in the home resulting from high wind conditions or in tight homes when local exhaust fans are used without adequate make-up air. Blocked or partially blocked flues may also cause back drafting. Flues should be inspected regularly. *If you suspect back drafting contact your furnace service representative or your fuel supplier.*

Power outages are a time of higher risk. During power outages, people often resort to the use of kerosene space heaters, fireplaces, gas ranges, and even barbecues to heat homes. Do not use barbecues or gas ranges for a heat source. If unvented fuel burning space heaters are used for warmth, be sure that windows are opened slightly to provide fresh air into the living areas. Additionally, gas ranges should not be used without local exhaust, such as exhaust fans or vented hoods that are exhausted to the outside.

### **Combustion**

Tobacco smoke, including second hand smoke, is a large source of CO in homes with smokers. Smokers have higher COHb values than nonsmokers and exposure to secondary tobacco smoke results in an increase in COHb values. Smokers generally have COHb values of five to six percent. Nonsmokers have COHb levels of 0.5

percent, whereas nonsmokers exposed to secondary tobacco smoke have been shown to have COHb levels in the two to three percent range.

### **Automobiles, Campers, RVs, and Boats**

CO produced from cars left running in closed garages can accumulate and enter the home. Traveling in truck canopies and campers presents an especially high risk for children. The University of Washington has reported deaths and loss of consciousness and other signs of CO exposure in children in Washington State who were affected while riding in covered pick-up truck beds. CO will accumulate in this space because the shape of the truck produces turbulence, which can lower the air pressure in the truck bed, drawing exhaust into the covered area. No one should ride inside covered truck beds. Every year there are deaths associated with CO poisoning. The majority of these deaths are associated with motor vehicle exhaust (CO) leaking into cars, campers, and motor homes. Be sure to provide adequate ventilation. It is important that cars and trucks have a functional "tight" exhaust system.

### **Prevention**

To prevent or reduce exposure to CO, be sure to provide ventilation during fuel burning appliance use, do not run cars in closed garages, and maintain your car's exhaust system. If your home has fuel-burning appliances you may want to obtain a CO alarm. These units are very similar to smoke alarms and warn occupants when CO levels become unsafe. There are also several monitors available that change color during CO exposure. These are not very precise in indicating CO levels. The Gas Company will test your home for CO if you are a customer and suspect a gas leak, smell combustion fumes, or describe symptoms associated with CO exposure. There are also independent testing labs that can test your home, for a fee. If you suspect a problem with a gas appliance, contact your gas supplier.

*If you think you have a problem act immediately: leave, call from outside the home, and do not return to the home until the problem has been resolved. Severe CO poisoning symptoms require emergency medical treatment.*

### **Contact for More Information**

Should you need additional information on carbon monoxide poisoning, please contact the following DOH Staff:

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